

**REMARKS**

As a preliminary matter, because claims 1-7 and 14-17 are submitted to be allowable over the cited prior art for the reasons discussed below and due to the relevant similarity between those claims and the non-elected claims (i.e., claims 8-13), it is respectfully requested that claims 8-13 be rejoined and allowed for reasons similar to those discussed below regarding claims 1-7 and 14-17.

Claims 1-7 and 14-17 stand rejected under 35 U.S.C. § 103 as being unpatentable over Bour et al. '063 ("Bour") in view of the remark. This rejection is respectfully traversed for the following reasons. Claims 1, 4, 5 and 7 are independent.

**I. PRIOR ART DOES NOT DISCLOSE OR SUGGEST CLAIMED INVENTION****A. Claim 1**

Claim 1 recites in pertinent part, "the mole fraction  $x$  of Al of the first semiconductor layer is set so that the lattice constant of the first semiconductor layer at room temperature substantially matches with the lattice constant of the second semiconductor layer in the bulk state after thermal shrinkage or thermal expansion" (hereinafter, "Lattice Matching"). The Examiner admits that Bour does not disclose Lattice Matching but nonetheless alleges that doing so would be obvious "since it was known in the art" to do so. It is respectfully submitted that the Examiner's reasoning is flawed because it assumes what it sets out to prove.

Indeed, Bour in view of the "remark" is effectively Bour in view of Applicants' specification. The "remark" relied on by the Examiner to cure the deficiencies of Bour are based solely on Applicants' specification and are NOT derived from the cited prior art. The

Examiner is directed to MPEP § 2143.03 under the section entitled "All Claim Limitations Must Be Taught or Suggested", which sets forth the applicable standard:

To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested **by the prior art**. (emphasis added) (citing *In re Royka*, 180 USPQ 580 (CCPA 1974)).

In the instant case, the pending rejection does not "establish *prima facie* obviousness of [the] claimed invention" as recited in claim 1 because the proposed combination fails the "all the claim limitations" standard required under § 103.

Nevertheless, contrary to the Examiner's allegation, it is respectfully submitted that Lattice Matching is NOT known in the art, and the Examiner has not provided any evidence that Lattice Matching is known in the art. Bour is completely silent as to setting the mole fraction of Al to any particular amount, let alone setting the mole fraction based on relative lattice constants of the respective semiconductor layers.

As described on page 4, lines 5-19 of Applicants' specification ("APA"), the conventional semiconductor growth method determines the lattice constants for the respective layers *leniently* by simply setting the Al mole fraction of the strain suppression layer at a value close to the cladding layers. However, when the temperature is lowered to room temperature after crystal growth, the difference in thermal expansion coefficients between the substrate and strain suppression layer causes the lattice constant thereof to change. Therefore, the lattice constants of the cladding layer(s) and strain suppression layer become different, leading to cracking or warping.

Only Applicants have considered such problems, and provided the means by which to solve those problems (*see, e.g.*, page 6, lines 8-14 of Applicants' specification). In particular, the present invention embodies a semiconductor whereby the mole fraction  $x$  of

Al of the first semiconductor layer is set so that the lattice constant of the first semiconductor layer **at room temperature** substantially matches with the lattice constant of the second semiconductor layer in the bulk state after thermal shrinkage or thermal expansion. In contrast, as noted above, APA discloses a strain suppression layer having a lattice constant that changes at room temperature so as to be different from the cladding layer(s) and is therefore subject to the aforementioned cracking and warping. Bour, on the other hand, is completely silent as to the problems related to lattice changes that may occur, let alone setting Al mole fractions to compensate for such lattice constant changes.

#### B. Claims 4, 5 and 7

Each of claims 4, 5 and 7 recite in pertinent part, a semiconductor **substrate** made of  $\text{Al}_x\text{Ga}_{1-x}\text{N}$  ( $0 \leq x \leq 1$ ). As noted in the Office Action, the Examiner relies on element **405** illustrated in Figure 5 as the semiconductor substrate. However, Bour expressly discloses the conventional materials for substrate 405, i.e., sapphire, silicon carbide or spinel (*see col. 7, lines 19-22*). Bour does not disclose or suggest that the substrate 405 is made of  $\text{Al}_x\text{Ga}_{1-x}\text{N}$  ( $0 \leq x \leq 1$ ).

The Examiner is again directed to MPEP § 2143.03 under the section entitled "All Claim Limitations Must Be Taught or Suggested", which sets forth the applicable standard:

To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested **by the prior art**. (citing *In re Royka*, 180 USPQ 580 (CCPA 1974)).

In the instant case, the pending rejection does not "establish *prima facie* obviousness of [the] claimed invention" as recited in claims 4, 5 and 7 because the proposed combination fails the "all the claim limitations" standard required under § 103.

## II. PROPOSED MODIFICATION OF BOUR IMPROPER

Moreover, even assuming *arguendo* that "remark" was indeed based on prior art rather than Applicants' specification, it is respectfully submitted that the Examiner still has not established that the claims are *prima facie* obvious. As is well known in patent law, a *prima facie* showing of obviousness can only be established if the prior art "suggests the desirability" of the proposed combination using *objective* evidence. The Examiner is directed to MPEP § 2143.01 under the subsection entitled "Fact that References Can Be Combined or Modified is Not Sufficient to Establish *Prima Facie* Obviousness", which sets forth the applicable standard:

The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. (*In re Mills*, 16 USPQ2d 1430 (Fed. Cir. 1990)).

In the instant case, even assuming *arguendo* that Bour can be modified by the "remark", it is submitted that the "mere fact that [Bour can be modified] ... does not render the resultant modification obvious" because nowhere does the *prior art* "suggest the desirability of the modification" as set forth by the Examiner. The Examiner is further directed to MPEP § 2143.01 under the subsection entitled "Fact that the Claimed Invention is Within the Capabilities of One of Ordinary Skill in the Art is Not Sufficient by Itself to Establish *Prima Facie* Obviousness", which sets forth the applicable standard:

A statement that modifications of the prior art to meet the claimed invention would have been [obvious] because the references relied upon teach that all aspects of the claimed invention were *individually* known in the art is *not* sufficient to establish a *prima facie* case of obviousness without some objective reason to combine the teachings of the references. (citing *Ex parte Levengood*, 28 USPQ2d 1300 (Bd. Pat. App. & Inter. 1993)).

In the instant case, even assuming *arguendo* that Bour and "remark" "teach that all aspects of the claimed invention [are] individually known in the art", it is submitted that such a conclusion "is not sufficient to establish a *prima facie* case of obviousness" because there is no *objective* reason on the record to modify the teachings of Bour. Only Applicants' specification provides the requisite rationale for the processes recited in the pending claims.

### III. DEPENDENT CLAIMS

Under Federal Circuit guidelines, a dependent claim is nonobvious if the independent claim upon which it depends is allowable because all the limitations of the independent claim are contained in the dependent claims, *Hartness International Inc. v. Simplimatic Engineering Co.*, 819F.2d at 1100, 1108 (Fed. Cir. 1987). Accordingly, as claims 1, 4, 5 and 7 are patentable for the reasons set forth above, it is respectfully submitted that all claims dependent thereon are also patentable. In addition, it is respectfully submitted that the dependent claims are patentable based on their own merits by adding novel and non-obvious features to the combination.

For example, with respect to claims 14-17, the Examiner admits that Bour does not disclose the claimed temperature range but relies on *In re Boesch* to allege that discovering an optimum value of a result effective variable involves only routine skill in the art. However, in the instant case, the Examiner has not established that the temperature range for the material gas is a result effective variable. The Examiner is directed to MPEP § 2144.05(II)(B) under the heading "Only Result-Effective Variables Can Be Optimized", which sets forth the applicable standard when applying *In re Boesch*:

A particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation. (citing *In re Antonie*, 195 USPQ 6 (CCPA 1977)).

In the instant case, Bour is completely silent as to the temperature of the gas material, let alone recognize the temperature of the gas material as achieving a recognized result. As described for example on page 19, lines 20+ of Applicants' specification, only Applicants have recognized that the claimed range can enable significantly reducing the crack density while improving flatness, thereby achieving a recognized result. Because Bour does not recognize the achieved result, pursuant to the cited MPEP section above, optimum or workable ranges of the temperature can NOT be characterized as routine experimentation.

With respect to claim 2, the Examiner refers to col. 8, lines 1-12. However, this portion of Bour is silent as to the relative Al mole fraction.

With respect to claim 6, the Examiner refers to col. 7, lines 19-21. However, this portion of Bour is silent as to the substrate 405 containing indium.

Based on all the foregoing, it is submitted that claims 1-7 and 14-17 are patentable over Bour. Accordingly, it is respectfully requested that the rejection of claims 1-7 and 14-17 under 35 U.S.C. § 103 over Bour be withdrawn.

### **CONCLUSION**

Having fully and completely responded to the Office Action, Applicant submits that all of the claims are now in condition for allowance, an indication of which is respectfully solicited. If there are any outstanding issues that might be resolved by an interview or an Examiner's amendment, the Examiner is requested to call Applicant's attorney at the telephone number shown below.

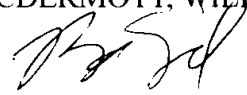
To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this

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paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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